

THE JAPANESE MARKET FOR CRUSTACEANS

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Smith, P., Kingston, A. and Battaglene, T. 1991 09 01: The Japanese market for crustaceans. *Memoirs of the Queensland Museum* 31: 409–419. Brisbane. ISSN 0079-8835.

The Japanese food market is undergoing major changes. Some of the factors influencing these changes on the Japanese seafood market are examined. These include supply-side developments, such as the impact of the rapid development of aqua-culture-sourced products and the changing availability of seafood from capture fisheries. On the demand side, they include the increased 'westernisation' of Japanese culture, changes in the demographic characteristics of the population, increasing incomes and wealth and improvements in the availability of alternative products. Results of recent ABARE studies of Japanese seafood demand are drawn upon, with an emphasis on those results relevant to crustaceans. Price relationships between seafoods, and between seafoods and meats are discussed, as is the growth in consumption in different market segments. □ *Japanese market, demand trends, prawn market.*

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Japan's limited agricultural base and its proximity to highly productive seas has resulted in its long recognised dependence on fisheries products as a source of protein. The importance of fisheries products in the Japanese diet increased significantly in the 1950s and 1960s. In 1960 fisheries products supplied almost three-quarters of the total intake of animal protein in Japan (ABARE, 1988: 277).

While consumption of all fisheries products has continued to increase, there have been major changes in the types of seafood consumed and in the factors influencing their consumption. The most apparent of these changes has been in crustacean consumption, which has increased from largely ceremonial and festivity use to more widespread general consumption.

To examine these changes in the Japanese market for crustaceans and the factors behind them, it is useful to first examine the changing demand and supply relationships between fisheries products and other foods before examining those factors specific to crustacean markets.

SUPPLY DEVELOPMENTS

DOMESTIC PRODUCTION

Although fisheries products were an obvious source of protein for the Japanese people, it is only since the Second World War that fisheries products have been consumed in very large quantities. Fisheries products were the main source of animal protein until the 1960s, as their

domestic production could be expanded to meet nutritional needs without the country having to use scarce foreign currency reserves to purchase imports of other foods.

As part of government efforts to improve dietary standards, the fishing industry was encouraged to expand into offshore and distant water operations. It did so successfully, and these fisheries provided Japan with the majority of its fisheries products and were the main source of growth in landings during the 1960s. However, in the 1970s two oil price shocks forced a rationalisation of distant water fishing (ABARE, 1988: 273). Reduced access to foreign waters resulting from the introduction of the exclusive economic zone regime over the period 1977–1980 reinforced this trend.

Despite an increase in production levels between 1970 and 1984 (Fig. 1), Japanese supplies of domestically landed fisheries products used directly for human consumption have remained relatively static. There have been significant changes in the catch composition, with an increase in the importance of lower valued pelagic species landed from offshore fisheries (10–200 nautical miles from shore). Sardine catches were negligible in 1970 but represented 42% of total catches in 1986. These species have not generally been used to meet consumer demand for fish, rather they have been used for processing — sardines into fishmeal, and others into fish-based consumer products such as surimi. Because of the increasing importance of these

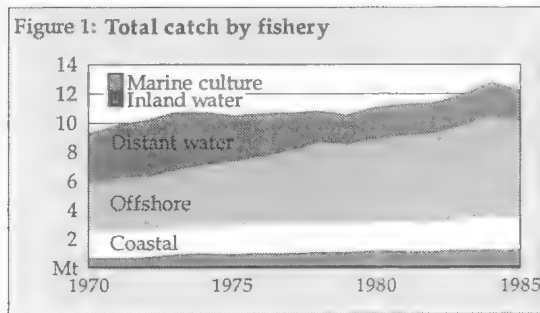


FIG. 1. Total catch by fishery.

species, the amount of domestically caught fish used directly for food has remained static since 1975 (ABARE, 1988: 268).

While representing only a very small component of total Japanese landings, production of crustaceans has shown a similar growth pattern, with output increasing during the late 1950s and the 1960s (Table 1) before stabilising at around 150 kt. Crab has been the main crustacean produced by Japan. Since 1970, crab landings have varied around 90 kt, with gazami (blue crab) and king crab the most valuable species per unit weight. Japanese spiny lobster production has been stable at around 1.1 kt. Prawn catches have varied around 60 kt. The most valuable species of prawns caught in Japanese waters are the white prawn taisho ebi (*Penaeus orientalis*) and a black striped prawn, kuruma ebi (*P. japonicus*), the latter because of its ceremonial importance.

The other main crustaceans which are highly valued for traditional use are gazami, snow crabs and Japanese spiny lobster.

There are limited prospects for increased domestic landings of crustaceans from capture fisheries. There has been considerable effort to increase domestic production through culturing of a number of crustacean species in Japan during the 1980s, and a culture industry has been established focussing on the market for live kuruma prawns (Fishery Journal, 1989). However, while much of the culture technology adopted worldwide was developed in Japan, the results of crustacean culture in Japan have been less successful than elsewhere, while in contrast the Japanese aquaculture industry based on fish and mollusc species has prospered.

FISHERIES TRADE

With the rapid expansion in fishing operations, Japan was a net exporter of fisheries products until the mid-1970s. However, during the 1970s imports of fisheries products increased rapidly, their value increasing threefold between 1975 and 1979 to over US\$4077m, while exports increased more slowly to around US\$700m. Since 1977, Japan has been the largest single importer of fisheries products, accounting for over 25% of the total value of world imports.

There was a number of demand and supply factors behind these changes. These included strong growth in demand for some high value products, due in part to increasing incomes and

TABLE 1. Japanese landings of crustaceans (liveweight).

	1960	1965	1970	1975	1980	1985
	t	t	t	t	t	t
Prawns						
— Freshwater	3 200	2 500	3 300	6 840	5 846	4 816
— Kuruma	3 100	3 100	nas	3 831	3 853	6 020
— Northern	—	—	—	1 996	1 609	—
— Other	57 300	63 400	66 300	63 340	45 524	48 971
Crab						
— Gazami	4 100	1 300	nas	4 229	2 807	5 227
— King	—	25 900	17 600	1 823	56	351
— Snow	9 400	16 400	19 100	24 187	21 314	10 322
— Other	33 900	20 000	53 300	46 030	53 382	83 737
Lobster						
— Japanese spiny	1 300	1 600	1 500	1 086	1 065	1 118

nas = Not available separately.
Source: FAO (1989).

TABLE 2. Japanese imports of edible fisheries products 1970-86: Product weight.

Product	1970 kt	1980 kt	1981 kt	1982 kt	1983 kt	1984 kt	1985 kt	1986 kt
Fresh, chilled or frozen fish								
- Tuna	36.6	108.4	110.2	137.0	149.2	120.3	156.7	157.6
- Other fish	54.6	232.3	346.4	425.8	450.4	530.8	614.4	748.0
Total	91.2	340.7	456.6	562.8	599.6	651.1	771.1	905.6
Fresh, chilled or frozen crustaceans and molluscs								
- Prawns	57.2	144.7	163.4	152.3	149.6	170.0	184.3	215.5
- Squid, cuttlefish, clams, abalone and oysters	57.3	177.4	189.3	103.8	215.3	230.4	232.8	173.1
- Other crustaceans and molluscs	0.9	68.5	71.7	70.3	77.6	97.1	109.2	214.6
Total	115.4	390.6	424.4	326.4	442.5	497.5	526.3	603.2
Processed fish, crustaceans and molluscs (salted, smoked or dried)								
- Fish and roes	9.4	45.0	49.1	53.0	30.8	58.6	56.4	58.3
- Crustaceans and molluscs	12.4	18.8	20.6	20.8	20.9	30.0	36.0	46.6
Total	21.8	63.8	69.7	73.8	51.7	88.6	92.4	104.9
Total imports	229.6 (88)	796.2 (681)	951.6 (808)	963.6 (976)	1 095.2 (944)	1 237.8 (878)	1 390.4 (1 146)	1 614.7 (1 071)
Excludes seaweed, agar-agar, oils and fats, pearl, live fish and shellfish, preparations not in airtight containers, corals, home aquarium fish, fingerlings for culture, caviar, sponges, shells, offal, wax and glue, nas = Not available separately. Note: Figures in parentheses indicate value in billion yen. Sources: JETRO (1981); Japan Tariff Association (1986).								

in part to their improved availability from overseas sources, and reduced domestic industry competitiveness due to lower resource availability and the appreciation of the yen.

Trade restrictions have also shaped Japanese fisheries trade, in two main ways. Firstly, there have been significant restrictions on imports of potential substitute products, such as beef (ABARE, 1988). Secondly, the types and quantities of fisheries products imported have been strongly influenced by quota and tariff restrictions. Quotas are imposed on four groups of fisheries products (ABARE, 1988: 30) while tariffs apply to most fisheries products. Tariffs applied to crustaceans range from 3% for frozen prawns to 6% for crabs. Higher tariffs are applied to processed products to encourage domestic processing of imported fisheries products.

The rapid growth in imports of fisheries products has had a major impact on Japanese markets over the 1980s. In 1970 imports sup-

plied 5.3% of the 5.6 Mt total of fisheries products used for food. By 1985 this had grown to 22.4% of a total of 8.4 Mt. The main growth in the period 1970 to 1985 was in imports of fresh and frozen fish, which increased eightfold to 770 kt. Crustacean and mollusc imports increased fivefold to 525 kt in the same period. The main single product in this category was prawns, imports of which increased from 57 kt in 1970 to 185 kt in 1985 (Table 2).

Imports of fisheries products have continued to rise strongly since 1985. Total imports of fisheries products have increased by 12% a year to 2661 kt in 1988, providing 30% of total seafood consumed in Japan (MAFF, 1990: 38). Prawn imports have increased at an average annual rate of just under 10% a year, reaching 263 kt in 1989. Crab and lobster imports, while much lower, have also recorded strong growth over this time (Table 3). However, the total value of

TABLE 3. Japanese imports of crustaceans.

Type	1985		1986		1987		1988		1989	
	t	¥'000	t	¥'000	t	¥'000	t	¥'000	t	¥'000
Prawns										
— Live	nas	nas	1685	5089	2775	7831	nas	nas	nas	nas
— Frozen	182 912	314 511	212 805	306 722	245 892	334 864	258 232	327 202	263 422	310 657
Crab										
— Fresh	nas	nas	nas	nas	nas	nas	2 192	1324	2 312	1 626
— Frozen	33 887	33 531	44 418	37 736	60 024	53 456	53 786	56 269	54 691	56 802
Rock lobster										
— Frozen	8 707	21 046	9 249	18 513	10 737	20 796	11 991	22 467	12 224	24 726
— Live	nas	nas	nas	nas	nas	nas	1 908	6 095	2 342	7 739
Total	225 506	369 088	268 157	368 060	319 428	416 947	328 109	413 357	334 991	401 550

nas = Not available separately.
Source: National Marine Fisheries Service (1990).

crustacean imports has risen only 2% a year over this period, to ¥400 million in 1989.

PRAWN IMPORTS

The rapid growth in supplies of imported prawns has dominated market prospects for crustaceans since 1985 and is likely to continue to do so through the next decade. In 1960, imports of prawns were only 0.6 kt but in only 30 years this has grown to well in excess of 250kt. However, the recent strong growth in imports has been mainly due to significantly lower prices. Since 1985 the unit value of Japanese prawn imports has fallen by an average of 7% a year (Fig. 2).

The growth in Japanese prawn supplies has been due to increased imports from three sources:

- aquaculture production;
- increased commercial fishing for prawns for export in preference to domestic (often subsistence) consumption; and
- increased concentration of the world prawn trade on the Japanese and, to a lesser extent, the US market.

Aquaculture has had a spectacular impact on world prawn supplies. Total cultured prawn production has grown from around 30kt in 1975 (2.3% of world supplies) to about 560kt in 1988 (26% of world supplies), an average annual growth rate of over 25%. Most of this growth in production has occurred in Asia, with large increases initially in Taiwan, China, Indonesia, the Philippines and, more recently, Thailand (Table 4).

Japan has been the most important market for cultured prawns, for a range of reasons. These include the close proximity to the main prawn

culture growth areas in Asia, and the Japanese market acceptance of black tiger prawns (the main cultured species) because of its similarity to kuruma and brown tiger prawns. The strength of the yen against other currencies, particularly the US dollar, has also allowed export returns to be maintained at high levels while Japanese wholesale prices have fallen. Without this appreciation of the yen it is unlikely that the Japanese market would have been able to sustain these growth rates.

The rapid growth in cultured prawn imports by Japan has had a number of important effects on the prawn market. These include major changes in the species composition and in the seasonality of supplies, and a major buildup in stock levels.

CHANGES IN SPECIES COMPOSITION

It is estimated that in 1989 Japan imported 118 kt of cultured prawns, some 45% of total prawn imports. Black tiger prawns were most important, with 86 kt, sourced mainly from: Indonesia (30.8 kt), Thailand (29.5 kt) and the Philippines

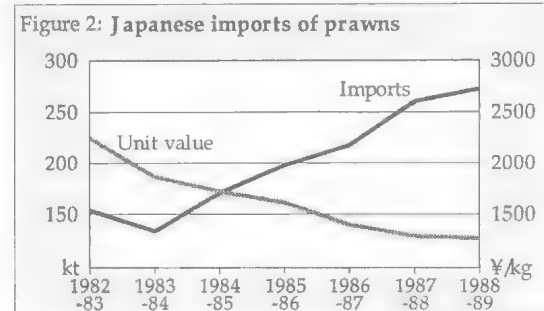


FIG. 2. Japanese imports of prawns.

TABLE 4. Cultured shrimp production in Asia, 1975–1988.

Country	1975 kt	1980 kt	1984 kt	1985 kt	1986 kt	1987 kt	1988 kt
China	0	2.0	22.0	35.0	70.0	153.0	180.0
Taiwan PC	0.3	5.0	17.0	33.3	65.0	75.0	45.0
Indonesia	10.0	28.0	33.0	39.0	48.0	55.0	82.5
Thailand	3.3	10.0	14.5	15.0	16.0	30.0	70.0
Bangladesh	4.0	7.0	11.5	12.5	13.5	14.5	18.0
India	4.0	12.0	14.0	16.7	18.4	22.0	23.5
Philippines	1.0	1.5	26.3	26.5	27.9	35.4	33.6
Vietnam	1.0	4.0	7.0	7.0	7.0	15.0	25.0
Sub-total	23.6	69.5	145.3	185.0	265.8	399.9	477.6
Other regions	16.7	20.5	29.7	25.0	39.2	100.0	82.4
World total	40.3	90.0	175.0	210.0	305.0	500.0	560.0

p = Preliminary. Source: Ferdouse (1989).

(16.5 kt), while the remaining 32.2 kt was of white prawns, mainly from China (Ferdouse, 1989).

The development of aquaculture has caused a major change in the species composition of imports. The Japanese market was previously heavily segmented on the basis of particular species and sizes for specific uses. Tiger prawns were largely restricted to use in functions which required a red striped colour for presentation purposes. The increase in supplies has resulted in their more widespread use in a range of other outlets which were previously supplied by other, less favoured, prawn types and sizes which had less demanded characteristics. This has, in turn, placed pressure on suppliers of other prawn types to try to maintain their own market position.

Cultured prawns have also drastically altered the size composition of supplies on the Japanese market. While the large majority of cultured prawns were previously of medium and small counts, technological changes in feeding and breeding technologies used have allowed culture operations to increase the size of prawn produced to take advantage of the higher prices for larger prawns. The consequence of this high grading is that price relativities between species and sizes have altered.

SEASONALITY OF SUPPLIES

The growth of cultured prawn supplies has drastically altered the seasonality of supplies on the Japanese market, particularly as a result of the instability of production of the main prawn exporters over the past four years. Prior to the

adoption of aquaculture, Japan had developed a pattern of stock buildup prior to the main periods of consumption (March to May and October to December). Imports and stock levels are now coming to be driven more by production considerations. This appears to be particularly the case with Chinese production and supplies from some other Asian countries where cold storage facilities are not available. Fig. 3A shows the imports of prawns by month for the past two years for the

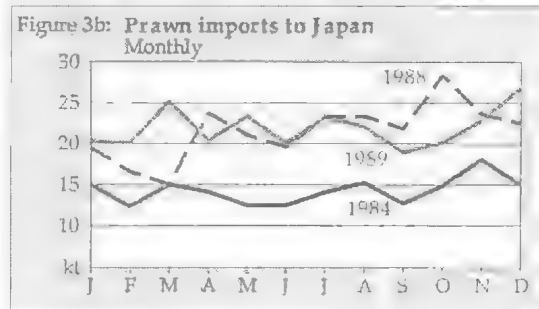
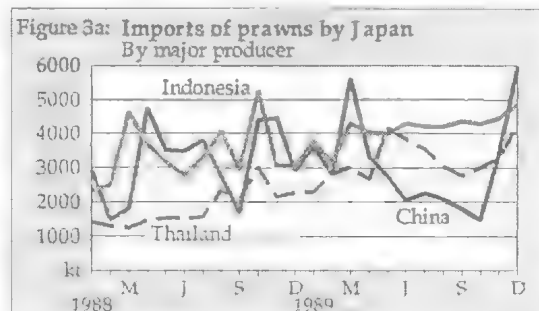


FIG. 3. Imports of prawns to Japan. a, by major producer; b, monthly.

TABLE 5. Consumption of fish and meat per person in Japan.

Year	Fish and shellfish	Pork	Poultry	Meat Beef and veal	Total	Total fish and meat
	kg	kg	kg	kg	kg	kg
1960	27.8	1.1	0.8	1.1	3.0	30.8
1965	29.2	2.7	1.9	1.6	6.2	35.4
1970	31.8	4.7	3.7	2.0	10.4	42.2
1975	34.9	7.5	5.3	2.6	15.2	50.1
1980	34.8	9.6	7.7	3.9	21.2	56.0
1981	34.1	9.6	7.9	4.1	21.6	55.7
1982	33.4	9.8	8.3	4.3	22.1	55.3
1983	34.2	9.6	8.6	4.6	22.8	57.0
1984	35.7	9.7	9.0	4.8	23.5	59.2
1985	35.8	10.3	9.2	4.9	24.4	60.2
1986	37.1	10.5	9.8	5.3	25.6	62.7
1987	38.1	11.2	10.3	5.6	27.1	65.2
1988	38.3	11.4	10.6	6.2	28.2	66.5

Source: ABARE (1988); MAFF (1989).

three largest exporters of prawns to Japan. Fig. 3B shows the total prawn imports by month for the past two years compared with 1984 to illustrate the changes which have occurred in import patterns.

COLD STORAGE HOLDINGS

A key feature of the Japanese market since the early 1980s has been the rapid buildup of prawn stocks in cold storage (Fig. 4). While initially stocks were held to match the seasonality of supplies with demand, the excess supplies on the Japanese market have resulted in growth of stocks to a level where they are likely to have a significant impact on prices paid to exporters.

DEMAND FOR FISHERIES PRODUCTS

AGGREGATE CONSUMPTION PATTERNS

Fundamental changes have taken place in the dietary patterns of the Japanese people. While the amount of food consumed per person has not al-

tered greatly — average calorie intake per person growing only moderately, from 2200 calories per day in 1960 to around 2500 calories per day in 1980 (Kester, 1980) — the composition of their food intake has changed considerably. Meat and seafood consumption has more than doubled since 1960 (Table 5). Consumption of carbohydrates, predominantly rice, has steadily fallen, from 115kg per person in 1960 to 88kg in 1975 and 73kg in 1986 (ABARE, 1988).

While consumption of fisheries products has continued to increase since 1965 it has done so at a slower rate — though from a higher base — than has consumption of meat products, with the result that fisheries' contribution to average daily intake of animal protein has fallen from 74% in 1965 to around 45% in 1988.

There are a large number of factors influencing the demand for a particular food, including its price, prices of substitute products, incomes, taste preferences, demographic factors and traditions. All of these factors have been important ele-

Figure 4: Prawn consumption

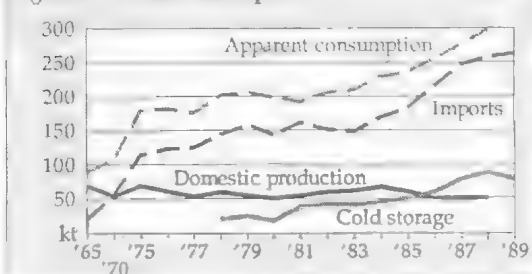


FIG. 4. Prawn consumption.

Figure 5: Relative consumer price movements

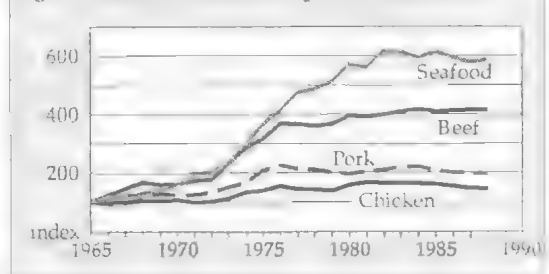


FIG. 5. Relative consumer price movements.

ments behind changes in consumption of fisheries products.

Fisheries products have become more expensive relative to pork and chicken (Fig. 5) and the changes in market shares may reflect consumer reaction to these changes in relative prices. Income levels have risen strongly over the period and changes in consumption may reflect an ability and willingness to purchase more desirable foods. Changes in lifestyle associated with increasing 'westernisation' of Japanese culture will also have influenced food demand.

To better identify the relative importance of the major factors behind changes in consumption of fisheries products, ABARE developed a model to analyse the implications of these changes on the demand for seafood (Kingston, Smith and Beare, 1990). Though a number of models of Japanese meat and seafood demand relationships have been developed in the past, most of these are now likely to be of limited relevance to the current situation in view of the changes which have occurred. (Summaries of the results of a number of these studies are provided in Coyle (1983) and in Dyck (1988).) Another major problem of earlier models is that they aggregate numerous seafood types, inevitably reducing the rigor of the analysis (Kester, 1980). More importantly from the perspective of people interested in a particular group of seafood products such as crustaceans, aggregated models do not provide the level of detail required to address the key issues, such as those associated with rapidly increasing prawn supplies.

The first aspect examined by Kingston *et al.* was the source of growth in consumption. Demand was examined at three levels: aggregate demand, household demand and demand outside the home. An important effect of Japan's increasing prosperity and 'westernisation' is that a high proportion of the increased quantities of meat and seafood eaten have been consumed outside the home. This pattern is consistent for each of the six commodities included in the study: beef, pork, chicken, tuna, other fish, and crustaceans (Fig. 6).

JETRO (1987) attributes this increase in eating-out partly to increased leisure time and increased disposable incomes. Another possible reason for the increased consumption outside the household is the fact that there are more working women in the workforce. Williams (1989) supports this claim, and notes that with the recent trend of working wives re-entering the workforce, most shopping is now done after work and

more meals are being consumed at restaurants in shopping centre areas. This trend has also resulted in a greater proportion of seafood being consumed in restaurants.

ESTIMATED PRICE RELATIONSHIPS

To establish the price relationships between the commodities a two stage demand system approach was used. In the first stage the demand relationships between the three meats and seafood were examined; in the second stage the seafood group was disaggregated into three commodities — crustaceans, tuna and other fish.

Tables 6 and 7 contain the estimates of the responsiveness of demand to changes in prices of these commodities in the market as a whole and in the household sector of the market. The *t*-ratios given below the estimates were calculated using Monte Carlo simulations of the parameter estimates using the variance-covariance matrix of the estimates.

The results obtained from the aggregate model suggest that the demand for seafood in total is relatively unresponsive to changes in its price but nevertheless more price responsive than are the other meats examined. Over the total Japanese market a 10% increase in seafood prices would be expected to result in an 8% reduction in consumption of seafoods and a boost to consumption of alternative meats, mainly chicken (up 6%) and beef (up 4%).

In the aggregate market the demand for individual seafoods (Table 6B) was found to be less responsive to price changes than was the demand for seafood in total (Table 6A), with a 10% increase in the 'own price' expected to result in a 4% fall in consumption of crustaceans, a 4.5% fall in tuna and a 6% fall in fish consumption. A surprising aspect of the results was the indication of a complementary relationship among the seafood commodities. For example, a rise in fish prices appears to have a similar downward effect on demand for crustaceans as on the demand for fish.

The household sector results (Table 7A) were consistent with expectations. The demand for beef was found to be highly responsive to changes in its price, a result consistent with its luxury status, while pork and seafood were less responsive. There was a strong substitution relationship between beef and seafood (meaning that an increase in the price of one commodity will lead to less consumption of that food and more consumption of the other), with the effect of seafood prices on beef demand much stronger

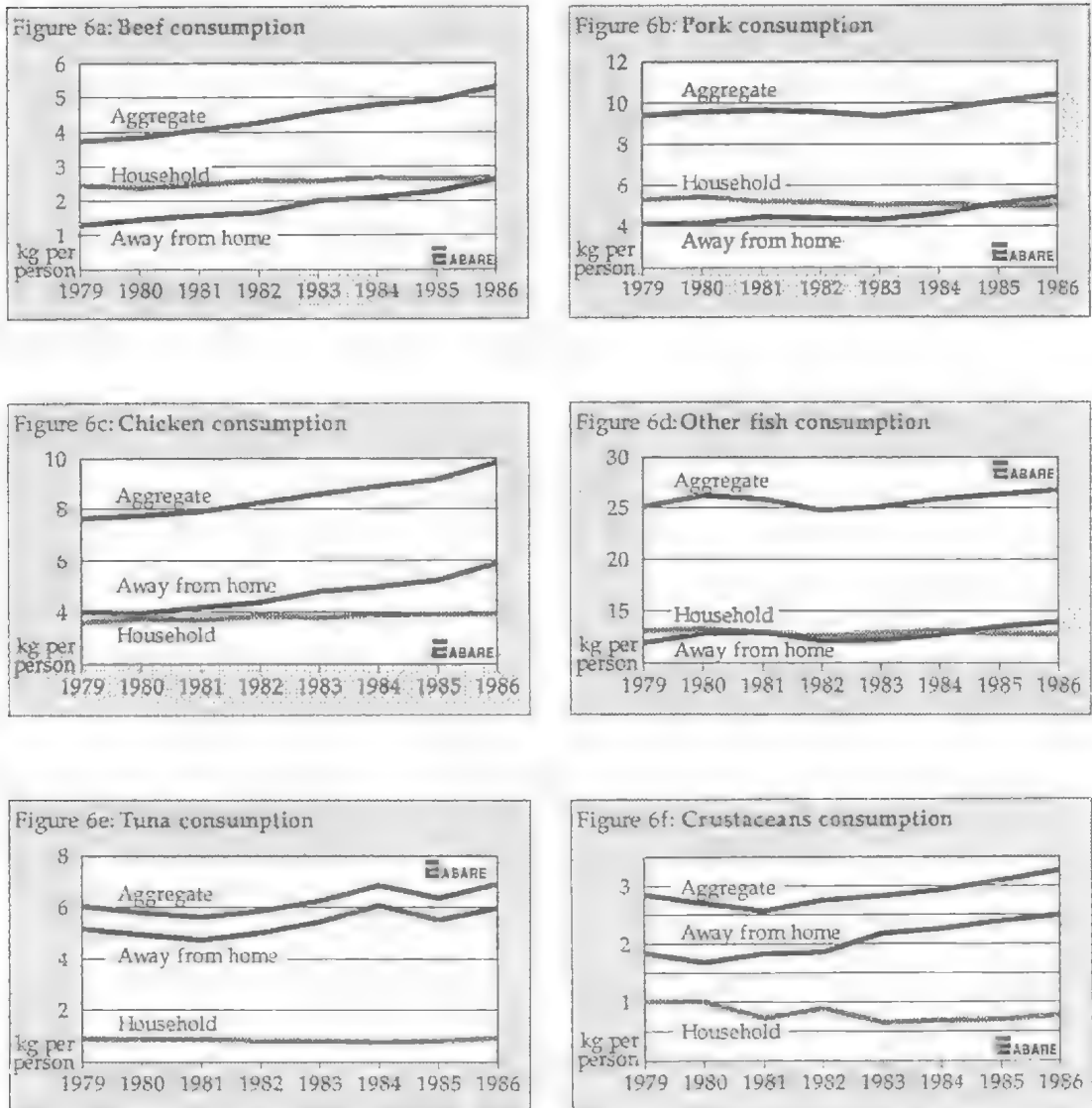


FIG. 6. Consumption of the six major commodity types. a, beef. b, pork. c, chicken. d, other fish. e, tuna. f, crustaceans.

than that of beef prices on seafood. A 10% rise in seafood prices was estimated to result in a 4% increase in beef demand while a similar rise in beef prices would only result in a 2% rise in seafood demand.

In the household sector the demand for crustaceans was found to be very strongly responsive to changes in prices (Table 7B) with a 10% fall in prices leading to a 32% increase in consumption. Tuna demand was also found to be strongly responsive to price changes, while other fish, being more of a staple food, was much less

responsive to price changes in the household sector. It is relevant to note that the demand for crustaceans was found to be far more responsive to changes in fish prices than was the demand for fish.

The difference in results between the home and aggregate analysis indicates that consumer behaviour is quite different in the household and away-from-home sectors. In particular, the lower price responsiveness in the aggregate seafood system, and implicitly in the away-from-home sector, suggests that factors other than

TABLE 6A. Aggregate meat and seafood system.

Response of demand for	with respect to change in price of			
	Beef	Pork	Chicken	Seafood
Beef	-0.62 (3.6)	0.24 (2.0)	-0.10 (1.0)	0.36 (1.9)
Pork	0.18 (1.8)	-0.52 (4.3)	-0.10 (1.0)	0.15 (1.0)
Chicken	-0.09 (1.0)	-0.06 (0.5)	-0.57 (3.2)	0.61 (2.5)
Seafood	0.12 (1.7)	0.07 (1.0)	0.26 (3.2)	-0.77 (4.5)

Source: Kingston *et al.* (1990). Figures in parentheses are t-ratios.

TABLE 6B. Aggregate seafood system.

Response of demand for	with respect to change in price of		
	Crustaceans	Tuna	Fish
Crustaceans	-0.39 (2.8)	-0.20 (2.0)	-0.54 (3.0)
Tuna	0.01 (0)	-0.45 (5.6)	0.02 (0)
Fish	-0.14 (3.5)	-0.10 (2.5)	-0.58 (6.4)

price, such as tradition, are important influences on aggregate seafood consumption. At the household level, the demand for individual seafood commodities, particularly crustaceans, shows strong price responsiveness. Significant substitution effects between the three seafoods were also identified.

Any fall in crustacean prices should increase overall crustacean consumption, with the greatest growth occurring in the household sector. Trade information supports this view, for although the household market accounted for only 25% of total crustacean consumption in 1986, around half of the increase in prawn supplies in 1988 was reportedly being sold through supermarkets for household consumption (FAO, 1990). There appears to be considerable potential to increase household crustacean consumption, though the substitution relationships in the household sector suggest that some of this increase will be at the expense of reduced tuna and other fish consumption.

RELATIONSHIP BETWEEN SEAFOOD AND BEEF

Particularly since the recent decision to liberalise the Japanese beef industry, an understanding of the relationship between the seafood and beef markets is of concern to the aquaculture and prawn fishing industries. Beef supplies are forecast to increase rapidly, and by 1991 consumption is expected to be 15% above current levels.

TABLE 7A. Household meat and seafood system.

Response of demand for	with respect to change in price of			
	Beef	Pork	Chicken	Seafood
Beef	-1.1 (7.2)	0.14 (1.4)	0.04 (0.5)	0.42 (2.3)
Pork	0.16 (1.6)	-0.4 (2.7)	-0.01 (0.1)	-0.2 (1.0)
Chicken	0.11 (0.5)	-0.01 (0)	-0.39 (1.0)	-0.13 (0.5)
Seafood	0.19 (3.2)	-0.04 (0.5)	-0.01 (0)	-0.43 (2.4)

Source: Kingston *et al.* (1990).

TABLE 7B. Household seafood system.

Response of demand for	with respect to change in price of		
	Crustaceans	Tuna	Fish
Crustaceans	-3.17 (9.6)	0.62 (2.4)	2.17 (8.0)
Tuna	0.54 (2.3)	-1.15 (3.5)	0.07 (0)
Fish	0.24 (8)	0.02 (0)	-0.68 (14)

The results suggest that any fall in beef prices following the increase in supplies will lead to a less than proportional increase in total beef consumption, and that growth will take place in both the household and away from-home-sectors of the market. However, no significant relationship was found between beef prices and seafood consumption at the aggregate level, suggesting that seafood consumption may not fall substantially with increasing beef consumption. There is some substitution between beef and seafood in the household sector, but changes in the price of seafood appear to have a far greater influence on beef demand than *vice versa* (an expected result, in view of their relative importance in consumption).

It should be noted that the consumption relationships were estimated in times of very rigid beef import restrictions. The magnitude of the expected change in beef supplies following trade liberalisation may be sufficient to alter existing consumption behaviour. However, it does seem that any resulting changes in seafood consumption will occur primarily at the household level. Since most crustacean consumption occurs on the away-from-home market, it seems unlikely that the changes taking place in beef trade will have a strong impact on crustacean markets.

INCOME GROWTH

Growth in income levels has been postulated as one of the main factors behind the changes in Japanese food consumption patterns. Japanese

economic growth remained consistently high in the 1960s and 1970s, with average annual increases in gross domestic product of 7.2% between 1960 and 1983, the highest of any OECD member (the average for all OECD countries was 3.7%). Even though Japan's savings rate is higher than in most other western industrialised countries, growth in private consumption expenditure in Japan was stronger than for other OECD countries with average growth of 5.1% per year over the same period (ABARE, 1988: 20–23).

Previous studies suggest that the influence of increasing incomes on consumption of prawns is likely to be very low. A study of prawn consumption from 1959 to 1981 showed that a 10% increase in per person income resulted in a 0.6% increase in prawn consumption, while the effect of prices was much stronger, with a 10% fall in prices resulting in an 8% rise in consumption (Rackowe *et al.*, 1983). While this study is now dated, the continued high importance of price factors suggest that the influence of consumer income on prawn consumption is still low.

IMPACT OF AQUACULTURE ON SEAFOOD DEMAND

Prawns are the dominant crustacean output from the aquaculture industry at the moment, but it seems inevitable that techniques will be developed to enable large scale farming of a wide range of fish and shellfish species. The consequences of such developments are likely to be substantial, significantly altering prices for those and substitute products.

As the results outlined indicate that Japanese demand for seafood in general, both in the aggregate market and in the household sector, is responsive to changes in seafood price, it would appear that increased supplies from aquaculture will result in a more than proportional fall in prices in order to stimulate consumption sufficiently to absorb those increases.

For aquaculture species of prawns, however, at current supply levels, import prices will largely be determined by the household market, as this is the marginal market for these prawns in Japan. The household market for crustaceans is extremely price sensitive, and a small fall in prices will lead to a very much larger percentage increase in household consumption. As a result this market may in future act as a buffer to further major falls in price. (Conversely, if there were any significant increase in retail crustacean prices, due to a reduction in imports or a weakening of the yen, the household market is likely to contract sharply to absorb those increases.)

The segmentation of the Japanese market, based on species characteristics, has weakened as a result of the strong growth of cultured supplies of black tiger and taisho prawns. There is now much greater emphasis on relative prices, and considerable substitution between farmed and captured prawns. With the continued strong growth in supplies of cultured prawns and ongoing marketing problems, a key issue for capture fisheries will be to protect their specific market niches. The price differentials between species and counts which existed prior to the expansion of aquaculture have changed considerably with the changes in species composition, and this trend will continue, with pressure to substitute black tiger prawns for more highly valued species with similar characteristics.

FUTURE PROSPECTS

The key influence on prospects for the Japanese prawn market is the likely future growth in supplies. While the large majority of capture fisheries are either at full exploitation levels or overexploited, there remain two potential areas of growth in supplies to the Japanese market — an increase in aquaculture production, and an increase in the proportion of production entering international trade.

Though a slowdown in growth is expected in the 1990s, it is nonetheless anticipated that cultured prawn production will be between 800kt and 1300kt by the mid-1990s. With capture fisheries largely fully exploited, this growth in cultured prawns will result in an increase in world supplies of between 11 and 33% to between 2300kt and 2800kt in the mid 1990s. The differences in these available estimates are crucial in examining the long term prospects for prawns, and point to the need for reliable monitoring of supply developments.

There are several factors which suggest that the recent downturns in prawn prices will result in only a minor slowing in the rate of increase in prawn supplies to Japan. Prawn exports have increasingly been encouraged as a means of raising foreign exchange earnings. This has resulted in a high emphasis on development of aquaculture operations geared to export markets, while in many capture fisheries it has meant a transfer from subsistence fishing to commercial operations, with a consequent increase in fishing effort and catches. It has also resulted in a higher proportion of total catches entering world trade.

As trade relations have improved in Asia,

prawn exports have been seen as one means of financing increased imports of manufactured goods. Both China and Vietnam have entered arrangements with Japan which have involved the transfer of fishing technology and vessels in exchange for prawns.

Much of the aquaculture industry in South-east Asia has also been developed specifically for the export trade. While it is difficult to assess the alternatives available to culture operations, it is likely that a high proportion of prawn culture operations have few alternative uses, particularly in the short and medium terms. The fall in Japanese prices is likely only to slow the rate of investment in new ventures. The lower costs of production in these countries, particularly in extensive and semi-intensive operations, is expected to ensure continued, but lower, profitability in existing prawn culture activities and only a small slowdown in the growth of supplies.

While there is scope for further increases in Japanese consumption of prawns, these increases will largely be as a result of lower prices to consumers. The results of the ABARE study outlined here suggest that to further stimulate Japanese consumption of prawns, some further falls in prices will be necessary, but these may be less severe than those recently experienced. However, a major contraction of supplies would be required before any recovery of prices on the Japanese market could take place.

ACKNOWLEDGEMENT

This research was supported by a grant from the Fishing Industry Research and Development Council.

LITERATURE CITED

- ABARE, 1988. 'Japanese agricultural policies: A time of change'. Policy Monograph No. 3. (AGPS: Canberra). 359p.
- COYLE, W.T. 1983. 'Japan's feed-livestock economy: Prospects for the 1980s. FAER-222'. (Economic Research Service, US Department of Agriculture: Washington DC).
- DYCK, J.H. 1988. 'Demand for meats in Japan. A review and update of elasticity estimates'. ERS Staff Report, AGES 880525. (US Department of Agriculture: Washington DC).
- FAO (Food and Agriculture Organization of the United Nations), 1989. Fishery Statistics: Catches and Landings 1987. Vol. 63 (Rome) (and previous issues).
- FAO, 1990. INFOFISH Trade News (Kuala Lumpur). February (and previous issues).
- FERDOUSE, F. 1989. 'Asian shrimp situation'. In INFOFISH Marketing Digest No.1/90. (FAO, Kuala Lumpur.)
- FISHERY JOURNAL 1989. Kuruma prawn culture in Japan. Fishery Journal 30: 3-7. (Yamaha Motor Co Ltd, Shizuoka).
- JAPAN TARIFF ASSOCIATION, 1986. 'Japan: Exports and imports — Commodity by country'. January (and previous issues).
- JETRO (Japan External Trade Organisation), 1981. 'Japanese fisheries and trade of fishery products'. AG-5, March (Tokyo).
1987. Food Market in Japan, AG-20. (Tokyo).
- KESTER, A.Y. 1980. 'Demand for fish in Japan and the westernization of the Japanese diet'. Paper presented to the workshop on Trans-Pacific Agricultural Trade, Resource Systems Institute, East-West Centre, Honolulu, Hawaii, 21-25 July.
- KINGSTON, A.G., SMITH, P.B. AND BEARE, S. 1990. 'Japanese seafood demand'. Paper presented to the 34th Conference of Australian Agricultural Economics Society, Brisbane, February 1990.
- MAFF (Ministry of Agriculture, Forestry and Fisheries, Japan) 1989. Statistical Yearbook of Japanese Agriculture, 1987-88 (and previous issues). (Tokyo).
- NATIONAL MARINE FISHERIES SERVICE, 1990. (NOAA, US Department of Commerce). 'Foreign Fishery Information Release No.90-5'. (and previous issues).
- RACKOWE, R., BRANSETTER, H., KING, D. AND KITSON, G., 1983. 'The international market for shrimp'. ADB/FAO INFOFISH Market Report, Vol.3. (Kuala Lumpur).
- WILLIAMS, S.C., 1989. 'The Japanese tuna markets: A fundamentalist's view'. Association of Business Academics Working Paper Series, (Darling Downs Institute of Advanced Education: Toowoomba).